CLAIMS

What is claimed is:

1. A micro-dimensional probe comprising:

   a) an electrode array attached to a substrate material;

   b) a nanotube array configured in a cantilever arrangement comprising a plurality of microparticulate ferromagnetic materials attached to the electrode array; and

   c) an electrical circuit coupling the electrode array to a probe component.

2. The micro-dimensional probe of claim 1, wherein the nanotube exhibits piezoresistance.

3. The micro-dimensional probe of claim 1, wherein the nanotube is a carbon nanotube.

4. The micro-dimensional probe of claim 3, wherein the carbon nanotube comprises at least one tubule with a Y-shaped or V-shaped morphology.

5. The micro-dimensional probe of claim 3, wherein the carbon nanotube has a multi-walled morphology.

6. The micro-dimensional probe of claim 4, wherein the tubule has a diameter ranging between 1 nanometer and 100 nanometers.

7. The micro-dimensional probe of claim 4, wherein the tubule has a diameter ranging between 1 nanometer and 50 nanometers.

8. The micro-dimensional probe of claim 4, wherein the Y-shaped or V-shaped morphology comprises a tubule having a length ranging between 0.1 micrometer and 100 micrometers.

9. The micro-dimensional probe of claim 4, wherein the Y-shaped or V-shaped morphology comprises a tubule having a length ranging between 1 micrometer and 10 micrometers.

10. The micro-dimensional probe of claim 1, wherein the ferromagnetic material comprises at least one transition metal.

11. The micro-dimensional probe of claim 10, wherein the transition metal is selected form the group consisting of iron, cobalt, nickel and combinations and alloys thereof.

12. The micro-dimensional probe of claim 1, that is part of a microscopic imaging device.

13. The micro-dimensional probe of claim 12, having a nanoscale dimension.

14. The micro-dimensional probe of claim 13, wherein the microscopic imaging device is an MFM or MRFM device.

15. The micro-dimensional probe of claim 14, that provides detection with nanoscale resolution.

16. An electrical contact probe, comprising at least one nanotube mounted on a substrate material, said nanotube comprising a conductive organic material and a plurality of microparticulate ferromagnetic materials coated thereon.

17. The electrical contact probe of claim 16, wherein the nanotube has low electrical resistance and high mechanical strength.

18. The electrical contact probe of claim 16, wherein the nanotube exhibits piezoresistance.

19. The electrical contact probe of claim 16, wherein the nanotube is a carbon nanotube.

20. The electrical contact probe of claim 19, wherein the carbon nanotube comprises at least one tubule with a Y-shaped or V-shaped morphology.

21. The electrical contact probe of claim 19, wherein the carbon nanotube has a multi-walled morphology.

22. The electrical contact probe of claim 20, wherein the tubule has a diameter ranging between 1 nanometer and 100 nanometers.

23. The electrical contact probe of claim 20, wherein the tubule has a diameter ranging between 1 nanometer and 50 nanometers.

24. The electrical contact probe of claim 20, wherein the Y-shaped or V-shaped morphology comprises a tubule having a length ranging between 0.1 micrometer and 100 micrometers.

25. The electrical contact probe of claim 20, wherein the Y-shaped or V-shaped morphology comprises a tubule having a length ranging between 1 micrometer and 10 micrometers.

26. The electrical contact probe of claim 16, wherein the ferromagnetic material comprises at least one transition metal.

27. The electrical contact probe of claim 26, wherein the transition metal is selected form the group consisting of iron, cobalt, nickel and combinations and alloys thereof.

28. The electrical contact probe of claim 1, that is part of a microscopic imaging device.

29. The electrical contact probe of claim 28, having a nanoscale dimension.

30. The electrical contact probe of claim 28, wherein the microscopic imaging device is an MFM or MRFM device.

31. The electrical contact probe of claim 30, that provides detection with nanoscale resolution.

32. A method of fabricating a probe for sensing or manipulating a microscopic environment or structure comprising the steps of:

a) preparing a substrate material comprising a plurality of surface metallic electrodes; and

b) attaching two branches of a Y-shaped nanotube on a pair of electrodes on the substrate material and having a third branch of said Y-shaped nanotube cantilevered outwardly from the surface of the substrate material.

33. The method of claim 32, wherein the nanotube exhibits piezoresistance.

34. The method of claim 32, wherein the nanotube is a carbon nanotube.

35. The method of claim 32, wherein the substrate material is a semiconductor material

36. The method of claim 32, wherein the substrate material is silicon.

37. The method of claim 32, wherein the substrate material is selected from the group consisting of a silicon wafer, silicon plate and silicon chip.

38. The method of claim 32, wherein the substrate material is a passivated semiconductor material.

39. The method of claim 38, wherein the substrate material comprises silicon, having silicon dioxide or silicon nitride, deposited thereon.

40. The method of claim 32, wherein the two branches of a Y-shaped nanotube are affixed to a pair of electrodes on the substrate material by electrodeposition, electroless deposition, or electron beam welding.

41. The method of claim 32, further comprising the step of a attaching a plurality of ferromagnetic materials on the terminus of one of the branches of the Y-shaped nanotube.

42. The method of claim 41, wherein the plurality of ferromagnetic materials is adhesively coated on the terminus of one of the branches of the Y-shaped nanotube.

43. The method of claim 41, wherein the plurality of ferromagnetic materials is adhesively attached on the terminus of one of the branches of the Y-shaped nanotube.

44. A method of sensing or manipulating a microscopic environment or structure using the micro-dimensional probe of claim 1, comprising:

a) passage of an electric current through the micro-dimensional probe; and

b) detecting a cantilever tip motion generated by the electric current passage through the micro-dimensional probe by measuring a change in piezoresistance upon deflection from the surface of a sample.